

**PERDIDO GROUNDWATER CONTAMINATION  
SITE  
EPA ID: ALD980728703**

**PERDIDO, BALDWIN COUNTY, ALABAMA**

**FINAL**

**SECOND FIVE-YEAR REVIEW REPORT  
FOR  
OU-1, GROUNDWATER OPERABLE UNIT**

**Prepared By:  
Mobile District  
U.S. Army Corps of Engineers  
P.O. Box 2288  
Mobile, Alabama 36609**

## EPA Five-Year Review Signature Cover

### Key Review Information

Site Identification			
Site Name: Perdido Groundwater Contamination Site		EPA ID: ALD 980728703	
Region 4:	State: AL	City/County: Perdido, Baldwin	
Site Status			
NPL Status: 9/1/1983			
Remediation Status: Operating			
Multiple OU's*      Y      N		Number of OU's: 1	
Construction Completion Date: 1992			
Fund/PRP/Federal Facility lead: PRP		Lead Agency: EPA Region 4	
Has site been put into reuse?   Y   N			
Review Status			
Who conducted the review?   U.S. Army Corps of Engineers			
Author name: Ernest R. McCollum		Author title: Geologist	
Author affiliation:   U.S. Army Corps of Engineers, Mobile District			
Review Period: May 24, 2000 – April 26,2000			
Highlight:      Statutory Policy	Policy type:	Review number: 2	
Triggering action event: 5 years since completion of initial 5-year review of ground water extraction system			
Trigger action date: 5/16/95		Due date: June 30, 2000	
* "OU" refers to Operable Unit			

**Deficiencies:**

No deficiencies were noted during this five-year review. The remedy fulfills the requirements of the ROD, the system is operational and effective and maintenance is ongoing and effective.

**Recommendations and Required Actions:**

The additional groundwater model checking, reconfiguring and evaluation recommended in the initial five-year review was performed and the required alterations made.

Figure 4, Benzene Isopleth Map from the December 1999 Quarterly Report, has closed contours indicating capture of the benzene plume. Figure 5, Water Table Elevations, from the December 1999 Quarterly Report does not indicate the closure shown on the Isopleth Map. After examining the data used to construct the Water Table Map, it appears that the contours can be closed on several of the open intervals, so that the groundwater contour map more closely resembles the benzene isopleth map.

**Protectiveness Statements:**

The remedy at OU-1 currently protects the human health and the environment because the groundwater remediation system prevents the uncontrolled migration of contaminants by maintaining an inward gradient and remediates the groundwater concurrently. Domestic wells in the affected area are no longer used because the affected residents were placed on a municipal water system.

**Signature of EPA Region 4, Waste Management Division Director and Date**

## Table of Contents

<b>I. INTRODUCTION .....</b>	<b>1</b>
<b>II. SITE CHRONOLOGY .....</b>	<b>1</b>
<b>III. BACKGROUND .....</b>	<b>3</b>
<b>IV. REMEDIAL ACTIONS .....</b>	<b>5</b>
<b>A. Remedy Selection .....</b>	<b>5</b>
<b>B. Remedy Implementation .....</b>	<b>5</b>
<b>C. System Operations .....</b>	<b>6</b>
<b>D. Progress Since Last 5-Year Review .....</b>	<b>7</b>
<b>V. FIVE-YEAR REVIEW FINDINGS .....</b>	<b>9</b>
<b>A. Five-Year Review Process .....</b>	<b>9</b>
<b>B. Site Inspection .....</b>	<b>9</b>
<b>C. Risk Information Review .....</b>	<b>10</b>
<b>D. Data Review .....</b>	<b>11</b>
<b>VI. ASSESSMENT .....</b>	<b>11</b>
<b>VII. DEFICIENCIES .....</b>	<b>12</b>
<b>VIII. RECOMMENDATIONS AND REQUIRED ACTIONS .....</b>	<b>12</b>
<b>XI. PROTECTIVENESS STATEMENT .....</b>	<b>13</b>
<b>X. NEXT REVIEW .....</b>	<b>13</b>

## **I. INTRODUCTION**

This 5-year review is to evaluate the performance of the remediation system installed for Operable Unit One (OU-1) at the Perdido Groundwater Contamination Site (PGCS), Perdido, AL. The Perdido Groundwater Contamination Site was placed on the National Priorities List (NPL) in September 1983 and was ranked number 665. An accidental spill at the site resulted in ground water contamination, that was discovered in 1982 when contaminants were detected in-off site wells.

The purpose of the 5-year review is to determine if the site remedy is protective of human health and the environment. In addition to the findings and conclusions of the reviews, deficiencies are identified and corrective actions are recommended. This is the second 5-year review for the Perdido Groundwater Contamination Site.

This review is required by statute. The United States Environmental Protection Agency (EPA) must implement five-year reviews consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA §121(c), as amended, states:

If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.

The NCP part 300.430(0(4)(ii) of the Code of Federal Regulations (CFR) states:

If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

## **II. SITE CHRONOLOGY**

Table 1 lists the chronology of events for the Perdido Groundwater Contamination Site.

**TABLE 1**  
**SITE CHRONOLOGY**

5/17/1965	Train Derailment and Benzene Spill
12/1981	Alabama Dept. of Public Health (ADPH) confirms odor in well water near Site
2/1982	ADPH samples 2 wells and confirms well contamination
Aug. & Sep 1982	Alabama Dept. of Solid and Hazardous Wastes (ADSHW) samples 27 additional wells and confirms contamination in 6
9/1982	Centers for Disease Control tests urinary phenol levels of 30 residents, no elevated levels detected
10/1982	Alabama Dept. of Solid and Hazardous Waste (ADSHW) and USEPA sample 49 wells, confirm contamination in 9
12/1/1982	Proposed NPL listing under CERCLA
9/1/1983	Finalized NPL listing, ranked 665
2/1983	EPA provides Immediate Removal Funds to furnish city water.
7/1983	Seaboard System RR (CSXT) provides funding and water line installations completed
9/1983	Field Investigation Team (FIT) contractors develop Remedial Action Master Plan (RAMP)
Late 1983	P.E. LaMoreaux & Assoc. (PELA) conduct field investigation
10/11/1985	Administrative Order on Consent to perform RI/FS
3/1987	USEPA performs solute transport model and soil vapor study recommending additional down gradient wells
9/1987	RI completed
5/1988	Supplemental RI report and FS submitted
9/30/1988	ROD
7/19/1990	Consent Decree
5/1992	Start remediation system construction
11/1992	Remediation system completed
6/1993	ESD approved and surface water discharge installed
3/6/1995	Initial 5-Year Review
9/8/1997	EPA approval to eliminate effluent-air treatment

### **III. BACKGROUND**

The Perdido Groundwater Contamination Site is located in the town of Perdido, Baldwin County, Alabama near the intersection of State Roads 47 and 61. The site consists of groundwater contamination originating from a 1965 train derailment by the Louisville and Nashville Railroad (now CSX Transportation, Inc.) which occurred approximately 200 yards east of the intersection of State Roads 47 and 61. Chemicals from the derailed tanks were spilled into the drainage ditches along State Road 61. As a result of the spill, the chemical Benzene penetrated through the soil and entered the groundwater aquifer used by area residents for their domestic well water.

The total area investigated during the remedial investigation covers an area of approximately 125 acres. The area of groundwater contamination covers approximately 15 acres and is centered downgradient about 300 yards from the derailment site.

A train derailment occurred on May 17, 1965 in which 21 cars of the 122 cars in the train derailed. The rail cars left the track near the intersection of county Highway 61 and Railroad Street, along the eastern portion of a curve in the track. Approximately 75% of the Benzene contents of the ruptured car was spilled. On the morning of May 19, 1965 the derailed cars were accidentally ignited by a cutting torch. The fire consumed the remaining Benzene.

It was not until December 1981 that the Alabama Department of Public Health, Division of Public Water Supply (ADPWS) first documented reports of taste and odor problems in Perdido residents' domestic water supply wells. Two wells were sampled in February 1982 that showed Benzene contamination. In August and September 1982, the Alabama Department of Solid and Hazardous Waste (ADSHW) sampled 27 additional wells and found 6 of these contaminated with Benzene. As a result of the Benzene contaminated wells, the Baldwin County Health Officer recommended that residents within a one mile radius of the derailment stop drinking or bathing with their well water. This affected approximately 250 residents in the area and over 300 students attending the junior high school. The National Guard provided two water tanks at the post office and the affected residents carried water home in plastic jugs.

In September 1982, the Center for Disease control (CDC) tested the urinary phenol levels of 30 residents whose wells were being tested for Benzene. None of the residents tested showed an elevated level of urinary phenol, so none could be shown to have had Benzene exposure at the time of the testing. Most of the people tested for urinary phenols had stopped drinking their well water long before the urine sampling.

Following the determination of the contaminated wells, the ADSHW requested support from the U.S. Environmental Protection Agency (U.S. EPA) to determine the extent of the groundwater contamination. During October 1982, ADSHW and the U.S. EPA conducted groundwater sampling of 49 domestic water wells. A total of nine wells were determined to be contaminated in the Perdido area. As a result of the findings of contaminated groundwater in Perdido, the U.S. EPA proposed on December 1, 1982 that the site be placed on the National Priorities List (NPL) under the Comprehensive Environmental Response,

Compensation, and Liability Act of 1980 (CERCLA) otherwise known as Superfund. Placement of the Perdido site on the NPL became final on September 1, 1983.

In early 1983, state and county officials requested that EPA provide Perdido with funding assistance under Superfund so that an alternate supply of drinking water could be provided to the community. Immediate removal funding was provided by EPA in February 1983 in order to construct a water line that would extend six miles from the nearby town of Atmore, Alabama and connect to the approximately 150 Perdido homes within a one mile radius of the derailment site. At the suggestion of EPA Region IV, Seaboard System Railroad (now CSXT) voluntarily provided funds for and installed the Perdido water system. The water line and hookup was completed July 1983.

As a result of the determination of Benzene contamination in the Perdido groundwater, several studies were initiated to define the extent of contamination.

Geophysical surveys were performed by the U.S. EPA's Field Investigation Team (FIT) contractors in 1982 and 1983. FIT also developed the Remedial Action Master Plan (RAMP) in September 1983. CSX Transportation, Inc. contractor, P.E. LA Moreaux (PELA), conducted a field investigation in late 1983.

On October 11, 1985, CSXT executed an Administrative Order on Consent (Docket No. 86-02-C) with the EPA to conduct a Remedial Investigation and Feasibility Study (RI/FS) on the site. The RI was begun in 1986 and completed in November 1987. In March of 1987 EPA's Groundwater Technology Unit and the Environmental Response Group conducted a solute transport model and a soil vapor survey respectively. Based on review of the data EPA requested additional monitoring wells to be installed further downgradient. The supplemental report was completed in May 1988. The RI confirmed the presence of Benzene in the groundwater. The FS was submitted to EPA in May 1988 and recommended groundwater extraction and treatment as the preferred remedial alternative for the site.

In September 1988 the EPA selected groundwater extraction with on-site treatment and reinjection as the site remedial action. The Record of Decision (ROD) was signed September 30, 1988. Target concentrations for the effluent groundwater are 5 parts per billion (ppb) for benzene and 1000 ppb for total suspended solids. A Consent Decree was signed by CSXT and EPA on July 17, 1990. Construction of the remediation system started in May 1992 and was completed in November 1992. During startup operations it was observed that the reinjection system was not capable of discharging the design flows. After addition system evaluation, public comment, and EPA approval of an Explanation of Significant Differences (ESD) a discharge line was installed from the treatment facility to Perdido Creek. Treated water from the system is discharged to the surface water only after the reinjection system has reached its capacity.



## **IV. REMEDIAL ACTIONS**

### **A. REMEDY SELECTION**

The ROD for the Groundwater Operable Unit at the Perdido Groundwater Contamination Site was signed on September 30, 1988. The selected remedy for the PGCS is pumping, on-site treatment and injection of the treated water on-site. The response actions for the PGCS were implemented to protect the public health and the environment by controlling the migration of contaminated groundwater in the Miocene Aquifer, the primary source for domestic users in the Perdido area. The U.S. EPA has determined that continued migration of contaminated groundwater is a major threat to the public health and the environment in the area surrounding and downgradient of the contaminant plume. The major components of the selected remedy are:

- Recovery of the contaminated groundwater by means of a recovery well field;
- Treatment of the recovered contaminated groundwater, by air stripping, to achieve the 5 ppb cleanup levels established for benzene, and;
- Injection of the treated groundwater back into the aquifer.

Operation and maintenance activities required to ensure the continue effectiveness of the selected remedy include:

- Periodic monitoring of the pump and treat system to ensure continued effectiveness in attaining the cleanup standard of 5 µg/l (ppb) of benzene in the groundwater;
- periodic groundwater monitoring to ensure that long term performance goals are being achieved.

The ROD estimated the aquifer cleanup would be completed in seven years and that continued groundwater monitoring would be required for five additional years to ensure the effectiveness of the cleanup.

### **B. REMEDY IMPLEMENTATION**

The Remedial Design Report for the PGCS was submitted in December 1991 and construction of the treatment system was accomplished from May 1992 through November 1992. The treatment system was comprised of twelve ground water extraction wells that supplied the contaminated groundwater to a Hazleton Maxi-Stripper System equipped with nine hydraulic venturi modules to supply outside air into the stripper. The effluent air was fed through a carbon adsorption tank prior to release to the atmosphere and the treated water was sent through a bag filter unit prior to being pumped to the injection wells.

During start-up of the system it was discovered that the injection wells were unable to inject the volume of water passing through the treatment system. The excess water flooded the injection system and activated a high level cut off switch that shut down the entire system.

To alleviate this problem and to allow the groundwater remediation to start a surface water discharge system was proposed to handle the excess water. In June 1993, after the EPA signed an Explanation of Significant Differences (ESD) a surface water discharge to Perdido Creek was installed.

### **C. SYSTEM OPERATIONS**

Operations and maintenance at the PGCS is performed by IMC Corp., a contractor for CSXT. IMC recently acquired the Mobile, AL operations of CET Environmental Services, Inc. The treatment facilities, extraction wells and injection wells appear to be exceptionally well maintained. The system is checked daily by Mr. D. C. Harville and a daily performance log is maintained. A weekly performance log is compiled by Mr. Harville and furnished to Mr. Hopkins (IMC) and to Mr. Steve Blair, Ogden Environmental and Energy Services, for incorporation into the quarterly reports.

At the time of this site inspection the remediation system is comprised of 15 extraction wells (WW-1 through WW-14 and IW-6), three biosparge wells, a New England Environmental Products low profile, shallow tray air stripper, two bag filter units, an air compressor for the biosparge wells and eight injection wells. Wells WW-6 and WW-11 are not being pumped and are located outside the plume on the most recent benzene isopleth map. The system originally had ten injection wells but IW-6 was converted to an extraction well and IW-5 is used as a monitoring well. Based on a review of the December 1999 Quarterly Report and conversation with Mr. Hopkins the system appears to be operating very well with only minor mechanical breakdowns and occasional power outages due to storms.

Since the system was modified, by changing from pneumatic extraction pumps to electric submersibles manufactured by Grundfos and by replacing the Hazelton stripper with a Northeast Environmental shallow tray stripper, maintenance problems have been reduced. The original system required considerable maintenance because the wells pumped sand and because of the high levels of iron in the groundwater. According to Mr. Hopkins (IMC), the abrupt cycling of the pneumatic pumps vibrated the wells and caused the wells to make sand. The sand and the iron precipitating out of the groundwater plugged the small orifices in the Hazelton stripper and each individual orifice had to be cleaned by hand with a small drill. Acid washing would not remove the clogs. A sand collection system was installed in June 1996 in an effort to alleviate sand clogging of the Hazelton stripper. Also, the frequent cycling of the wells resulted in pump and controller failures and in increased maintenance frequency and costs.

The November 1999 sample of the effluent water was 20 ppb, which was well above the regulatory limit of 5 ppb, and was attributed to iron buildup in the air stripper. Iron and sediment fouling is an on going problem and the causes of the fouling are being addressed by Ogden Environmental. According to the December 1999 Quarterly Report, the cleaning schedule for the New England stripper has been significantly modified to reduce the potential for benzene exceedances (>5 ppb) in the effluent due to the continued build up of iron and/or sediment in the stripper. The stripper will be inspected and cleaned every two weeks using an internal cleaning wand. The stripper will be dismantled, inspected and cleaned quarterly.

O&M costs are summarized in the following table:

**TABLE 2**  
**ANNUAL O&M COSTS**

<b>Dates</b>		<b>Total Cost rounded to nearest \$100</b>
<b>From</b>	<b>To</b>	
1994	1995	\$ 317,300
1995	1996	\$ 358,300
1996	1997	\$ 386,200
1997	1998	\$ 467,500
1998	1999	\$ 438,100
1999	2000 (ytd)	\$ 161,600

#### **D. PROGRESS SINCE LAST 5-YEAR REVIEW**

The Statement on Protectiveness from the Initial 5-Year Review states:

“Based upon the groundwater monitoring results, the remedial action appears to be performing as intended. Benzene concentrations have declined from high values of 28.5 ppm (28,500 ppb) to 9.3 ppm (9,300 ppb) in the most recent quarterly sampling data. Since there are no domestic water wells currently in use within a one-mile radius, there is no threat to public health (this has been confirmed by ADPH). Review of the effluent data indicate that vapor discharge to the atmosphere as well as injected water and surface water is clean. So long as the system is maintained, the treatment system will function to reduce levels of contaminants below cleanup standards. Handling and manifesting of contaminated media is being properly shipped off-site reducing any potential exposure to the local community.”

The system has been properly maintained and the effectiveness of the system has been substantially increased. Based on the two most recent quarterly sampling reports (Sep. 99 & Dec. 99) benzene concentrations appear to be lower than those stated in the initial 5-year review. Refer to Table 3 for the most recent results:

**TABLE 3****RECENT BENZENE SAMPLING RESULTS (PPB)**

	July	August	September	October	November	December
Water Influent	290	330	300	290	140 (180)	180
Water Effluent	nd	nd	nd	nd	20* nd	1.3
Air Effluent	7	4	7	7	5 (3.4)	25

\* Benzene concentrations exceeded regulatory limit of 5ppb. An acid wash of the air stripper was performed and the bag filters were replaced to restore system performance. After cleaning the treatment system, a sample of the discharge was collected to confirm system performance. Benzene was not detected in the confirmation sample ( ).

Numerous changes have been made to the remediation system at the PGCS and are documented in the following table:

**TABLE 4****CHANGES AND MODIFICATIONS SINCE LAST REVIEW**

<b>Date</b>	<b>Change/Modification</b>
July 20, 1995	Change to CET Environmental Services for O&M
April 4, 1996	EPA approves sand removal system
June 1996	Install sand removal system
December 30, 1996	Change from ENSR to Ogden Environmental as consultant
September 8, 1997	EPA approves removal of carbon adsorption system
November 1997	Removed carbon adsorption tank, replaced pneumatic well pumps with electric submersibles, performed Geoprobe screening to define benzene plume.
March 24 – April 14, 1998	Replaced Hazelton Maxi-Stripper with a New England Environmental Products Shallow Tray Mod. 41251 Stripper.
August 25, 1998	Submitted Work Plan for Supplemental Well Installation, to install 3 biosparge and 2 extraction wells.
November 2, 1998	EPA approves work plan
January 16, 1999	Well installation completed
October 1999	IMC, Corp. buys CET Environmental Services, retains personnel (Mr. Hopkins, Mr. Harville) familiar with site.
October 25, 1999	Submitted additional Work Plan for Supplemental Well Installation that proposes 2 extraction wells, 8 biosparging wells and 1 source area monitoring well.
December 1, 1999	Installed source area monitoring well OW-41

February 22-25, 2000	Installed 8 biosparge wells
April 5, 2000	Started installation of 8 extraction wells and one additional biosparge well

A review of the September and December 1999 Quarterly Reports indicate that the system is functioning as intended, is capturing the benzene plume and is remediating the ground water. The electric submersible pumps coupled with the shallow tray air stripper seem to be effective, efficient and more cost effective to operate. The problems with iron clogging the stripper are being investigated and an aggressive cleaning schedule has been established.

## **V. FIVE-YEAR REVIEW FINDINGS**

### **A. FIVE-YEAR REVIEW PROCESS**

The Perdido Groundwater Contamination Site five-year review was lead by Mike Arnett, EPA remedial Project manager for the PGCS. The five year review consisted of the following activities: document review, limited data review and a site inspection. The following persons attended the site inspection:

**TABLE 4**

#### **SITE INSPECTION ATTENDEES**

<b>Name</b>	<b>Company</b>	<b>Job Title</b>	<b>Telephone No.</b>
Clyde Hopkins	IMC Corp.	Division Manager	(334) 580-9400
Metz Duites	ADEM	Env. Engineer	(334) 271-7749
Ross McCollum	COE, Mobile	Geologist	(334) 690-3113
Adrienne Jones	COE, Mobile	Env. Engineer	(334) 690-3091
Frances Spaller	COE, Mobile	Chem. Engineer	(334) 690-3337

### **B. SITE INSPECTION**

The site inspection took place at 10 AM on April 5, 2000. The attendees met at the treatment facility building and introductions were made. A brief explanation of the 5-year review process was given so that all the team members were familiar with the process.

Mr. Hopkins gave a brief presentation on the site history and a safety briefing prior to starting the site tour. The site inspection started at the treatment facility where Mr. Hopkins explained the treatment process.

The influent water enters the building and goes directly into a cone bottomed sand separator where the sand is supposed to settle out. After desanding the water is piped into the New

England Environmental Products gravity fed, shallow tray air stripper. The unit is equipped with four trays. A blower unit discharges the effluent air through a stack installed through the roof.

The effluent water is pumped to a two unit bag filter system. Each unit contains eight one micron bag filters. Pressure drop across the system is recorded daily and the results are used to determine when a bag change is required. After filtering, the treated water is pumped to the injection wells for injection into the aquifer, or sent to the surface water discharge at Perdido Creek.

After inspecting the treatment building the team went and examined the extraction well and biosparging well system. Biosparge well BS-1 was opened for inspection and Mr. Hopkins explained the air supply valving and piping layout. The well was functioning and in good condition. Refer to Attachment E Site Photographs.

Extraction well WW-12 was opened for inspection. The well was operating and was in good repair. The wells are now equipped with Grundfos submersible pumps and controllers. The pumps have no-load sensors so that if the well is pumped down to the pump intake, the pump will shut off instead of running until it burns up. Some of the pumps are capable of pumping more water than they are pumping at this time. The pump discharges are throttled back and wells are pumping against a discharge pressures of 10-100 psi. After replacing the cover on well WW-12 the team looked at the extraction wells down to Highway 47.

The team then went by the derailment site and inspected the surface water discharge. The discharge is located in Perdido Creek on the south side of Baldwin County Highway 61. The culverts under the road have recently been replaced and the roadside and creek banks riprapped. The discharge is inconspicuous and appeared to be operating well within the 100 gpm discharge limit.

### **C. RISK INFORMATION REVIEW**

The following applicable or relevant and appropriate requirements (ARARs) were identified in the ROD and initial five-year review and were reviewed as a part of this five-year review:

- ! Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- ! Resource Conservation and Recovery Act (RCRA)
- ! Occupational Safety and Health Act (OSHA)
- ! Federal Maximum Contaminant Levels (MCL's) under the Safe Drinking Water Act
- ! National Pollutant Discharge Elimination System (NPDES)

The MCL for benzene has remained unchanged at .005 mg/L (5 ppb) and benzene is the only contaminant of concern at the PDCS. The State of Alabama does not require a NPDES permit for the discharge to surface water, but does maintain the maximum 100 gpm discharge rate requirement.

## D. DATA REVIEW

The summary for the December 1999 Quarterly Report states that the system treated 21,561,000 gallons of groundwater for the last quarter of calendar year 1999; 82,822,343 gallons for the year 1999 and 313,284,143 gallons since system startup. The initial five-year review reported historical benzene levels as high as 28,500 ppb. The most recent data indicated levels varying from 1800 ppb in well OW-28 to <1 ppb in several wells and total system influent varied from 140 ppb to 330 ppb at the treatment plant.

An inspection of the water level data indicates that the groundwater extraction system is capturing the benzene plume and the treatment system is performing as designed and removing the benzene from the groundwater. The remedial objectives of extracting the contaminated groundwater, treating the groundwater, and disposing of the treated water are being met.

## VI. ASSESSMENT

Based on the results of the site inspection of the PGCS it has been determined that the site remedy remains protective of human health and the environment:

### A. *Have Conditions External to the Remedy Changed Since the Remedy was Selected?*

**! *No Changes in Land Use:*** There are no new or planned changes in the current land use. CSXT bought the plant site when it became available on the market. The surrounding land is lightly developed residential and commercial. CSXT maintains lease agreements to have access to the wells.

**! *No Changes in known Contaminants, Sources, or Pathways at the Site:*** No new contaminants, sources or pathways were identified during this five-year review.

**! *No Changes in Known Hydrologic/Hydrogeologic Conditions:*** The decline of benzene concentrations in the groundwater is consistent with the goals and expectations of the remedy when it was selected. The basic hydrogeologic conditions have not changed, but have been better defined by additional investigation and data analysis since the last five-year review and system efficiency has been improved.

### B. *Has the Remedy been Implemented in Accordance with Decision Documents?*

**! *Health and Safety Plan:*** A health and safety program and plan are in place and have been implemented. The safety plan is sufficient to control risks at the site.

**! *Access and Institutional Controls:*** The treatment facility is secured by a well maintained fence and is locked to prevent unauthorized access. The wells are secured inside locked tamper resistant vaults and are well protected. The system is secured as well as possible.

**! *Remedy Performance:*** The groundwater extraction and treatment system is functioning successfully, cleanup goals are being met and an inward gradient appears to have been established.

**! *Adequacy of System Operations:*** The system is operating adequately. The problems encountered with iron encrustation and sediment buildup are common problems with groundwater pumping systems. The solution to these problems is good system surveillance and maintenance and that is being provided at this site.

**! *Need for Optimization:*** Ogden Environmental is actively engaged in optimizing the systems performance. Additional extraction wells and biosparging wells were installed starting on April 5, 2000.

**! *No Early Indicators of Potential Remedy Failure:*** No early indicators of potential remedy failure were noted during the site inspection or data review. The system has been upgraded to improve its performance and a strong maintenance program is in place.

#### ***C. Has any Risk Information Changed Since the Remedy was Selected?***

**! *Changes in ARAR's*** The five year review did not identify any changes in the ARAR's since the ROD was signed.

### **VII. DEFICIENCIES**

No deficiencies were noted during this five-year review. The remedy fulfills the requirements of the ROD, the system is operational and effective and maintenance is ongoing and effective.

### **VIII. RECOMMENDATIONS AND REQUIRED ACTIONS**

The additional groundwater model checking, reconfiguring and evaluation recommended in the initial five-year review was performed and the required alterations made.

Figure 4, Benzene Isopleth Map from the December 1999 Quarterly Report, has closed contours indicating capture of the benzene plume. Figure 5, Water Table Elevations, from the December 1999 Quarterly Report does not indicate the closure shown on the Isopleth Map. After examining the data used to construct the Water Table Map, it appears that the contours can be closed on several of the open intervals, so that the groundwater contour map more closely resembles the benzene isopleth map.

### **IX. PROTECTIVENESS STATEMENT**

The remedy at OU-1 currently protects the human health and the environment because the groundwater remediation system prevents the uncontrolled migration of contaminants by maintaining an inward gradient and remediates the groundwater concurrently. Domestic wells in the affected area are no longer used because the affected residents were placed on a municipal water system.



## **X. NEXT REVIEW**

This is a statutory site that requires ongoing five-year reviews. The next review will be conducted within five years of the completion of this five-year review report. The completion date is the date of the signature shown on the signature cover attached to the front of the report.

### **Attachments:**

- Attachment A: Documents Reviewed
- Attachment B: Site Maps
- Attachment C: Sampling Data Results
- Attachment D: Site Inspection Checklist
- Attachment E: Site Photographs

**PERDIDO GROUNDWATER CONTAMINATION  
SITE**

**EPA ID: ALD980728703**

**PERDIDO, BALDWIN COUNTY, ALABAMA**

**ATTACHMENTS TO  
FINAL**

**SECOND FIVE-YEAR REVIEW REPORT  
FOR  
OU-1, GROUNDWATER OPERABLE UNIT**

**Prepared By:  
Mobile District  
U.S. Army Corps of Engineers  
P.O. Box 2288  
Mobile, AL 36609**



## **ATTACHMENT A**

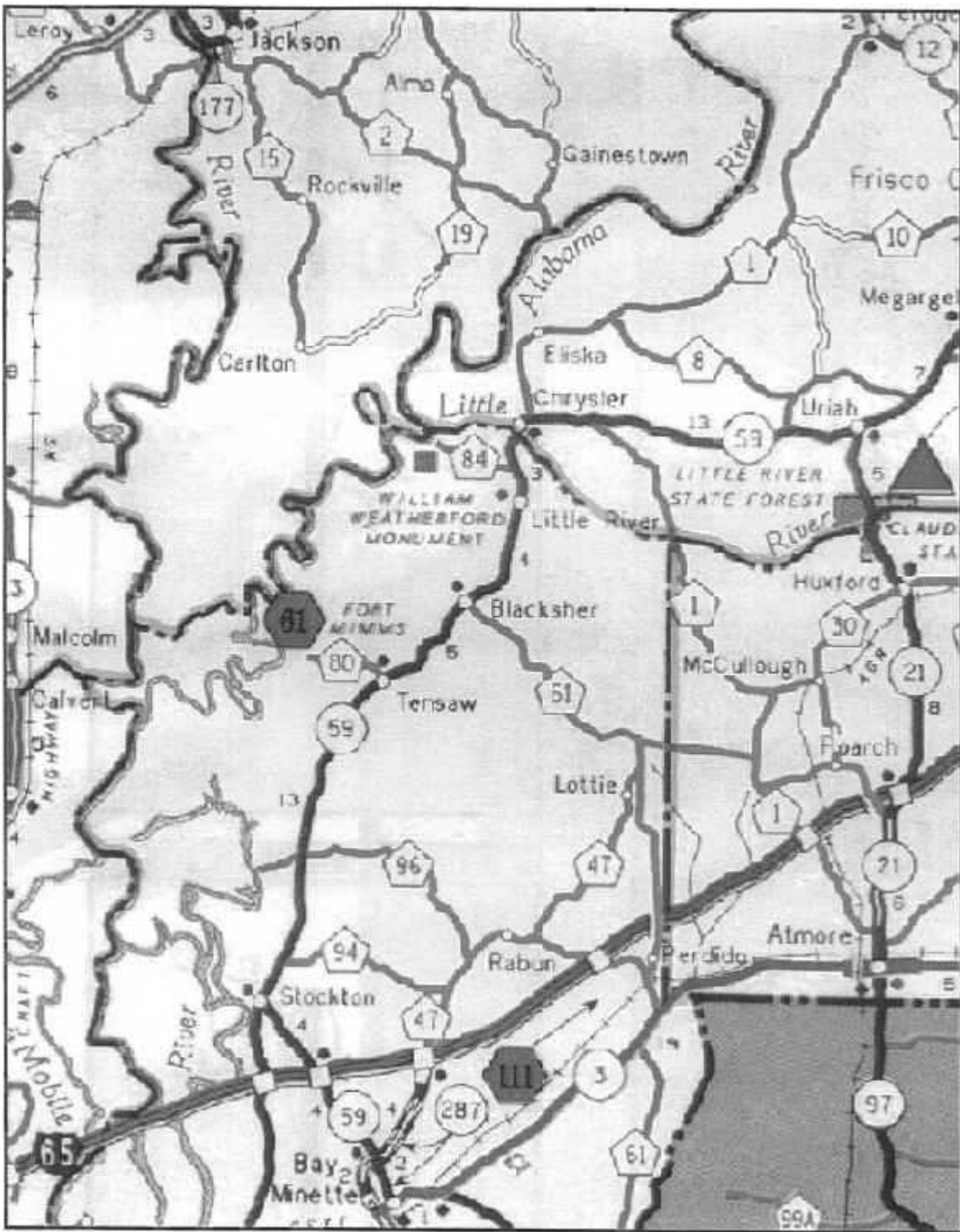
### **DOCUMENTS REVIEWED**

1. Record of Decision, Summary of Remedial Alternative Selection, Perdido Groundwater Contamination Site, Perdido, Baldwin County, Alabama, U.S. Environmental Protection Agency, Region IV, September 30, 1988.
2. Consent Decree, United States of America v. CSX Transportation, Inc., July 19, 1990.
3. Five-Year Review Report, Perdido Groundwater Contamination Site, Perdido, Baldwin County, Alabama, Roy F. Weston, Inc., May 1995.
4. Supplemental Well Installation Work Plan, Perdido Groundwater Remediation Site, Perdido, Alabama, Ogden Environmental and Energy Services Co., Inc., August 25, 1998.
5. Supplemental Well Installation Work Plan, Perdido Groundwater Remediation Site, Perdido Alabama, Ogden Environmental and Energy Services Co., Inc., October 5, 1999.
6. September 1999 Quarterly Report, Treatment System Operation, Maintenance, and Performance Monitoring, Executive Summary, Perdido Groundwater Remediation Site, Perdido, Alabama, Ogden Environmental and Energy Services Co., Inc.
7. December 1999 Quarterly Report, Treatment System Operation, Maintenance, and Performance Monitoring, Perdido Groundwater Remediation Site, Perdido, Alabama, Ogden Environmental and Energy Services Co., Inc., February 4, 2000.
8. Submittal of the Sand Removal System Installation and Startup Report for the Perdido Groundwater Treatment System in Perdido, Alabama, ENSR Consulting and Engineering, January 22, 1997.
9. Superfund Program Explanation of Significant Differences Fact Sheet, Perdido Groundwater Contamination Superfund Site, Perdido, Baldwin County, Alabama, U.S. Environmental Protection Agency, Region IV, May 1993.
10. Treatment Plant Effluent Discharge, Perdido Groundwater Remediation Site, Perdido, Alabama, Memorandum, Ogden Environmental and Energy Services Co., Inc., June 4, 1997.
11. Summary of Geoprobe Screening Investigation, Perdido Groundwater Remediation Site, Perdido, Alabama, Memorandum, Ogden Environmental and Energy Services Co., Inc., December 8, 1997.
12. Treatment Plant Effluent Discharge, Perdido Groundwater Remediation Site, Perdido, Alabama, Memorandum, Ogden Environmental and Energy Services Co., Inc., January 8, 1998.

13. Treatment Plant Effluent Discharge, Perdido Groundwater Remediation Site, Perdido, Alabama, Ogden Environmental and Energy Services Co., Inc., July 9, 1999.

# **ATTACHMENT B**

## **SITE MAPS**



PERDIDO GROUNDWATER SITE  
LOCATION MAP





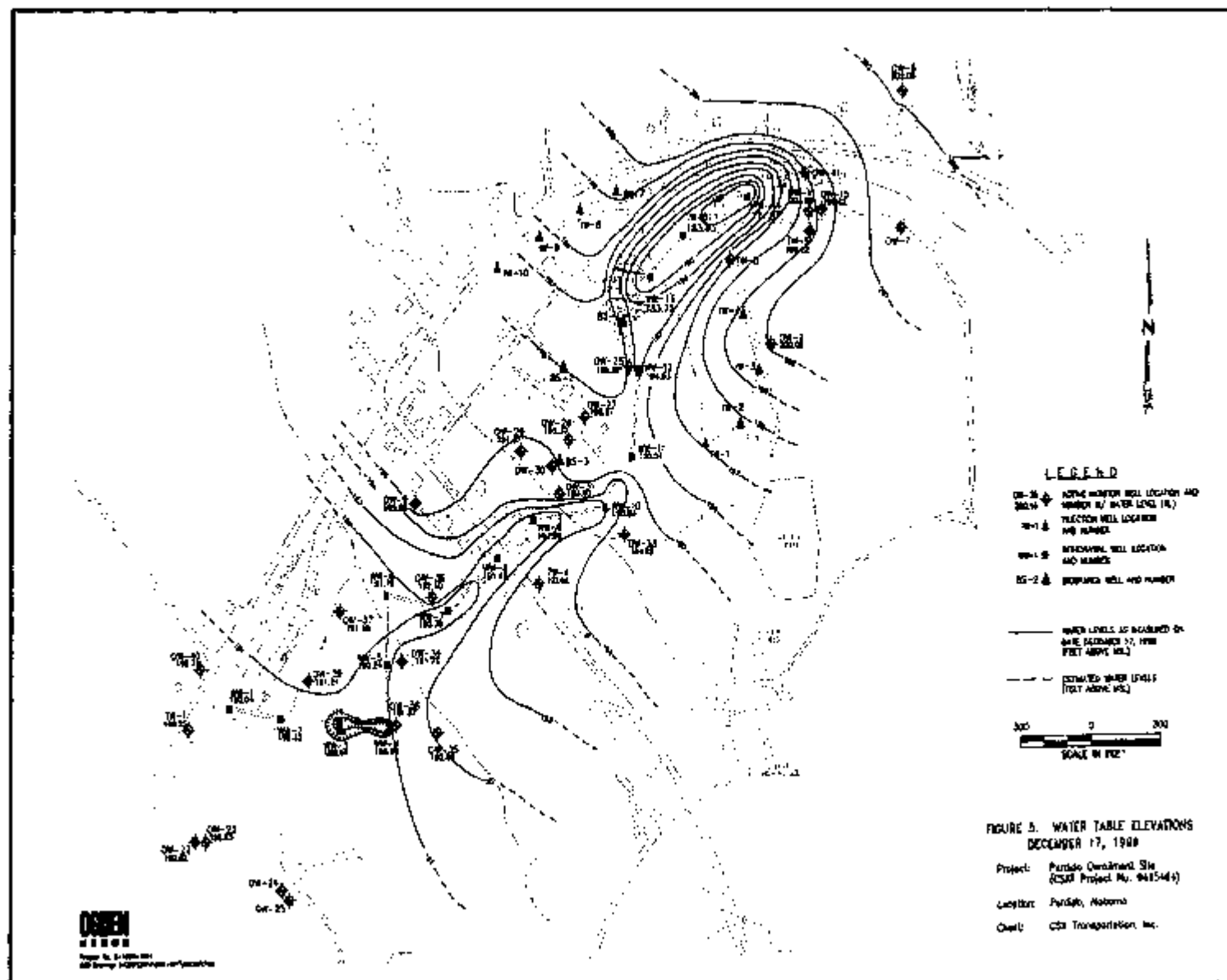
**ATTACHMENT C**

**SAMPLING DATA**

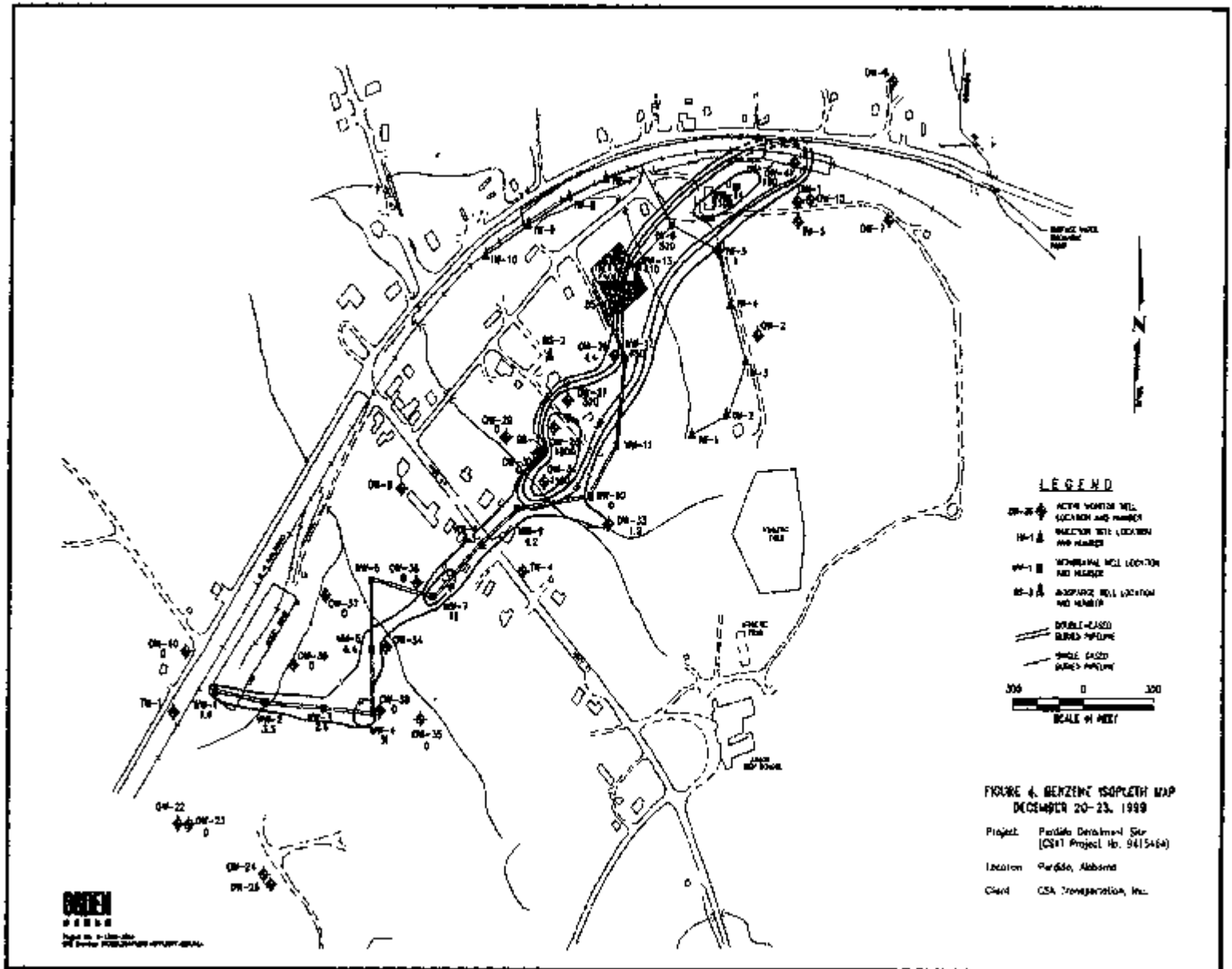
<b>Well:</b>	<b>Lab ID</b>	<b>Date Sampled</b>	<b>Type Sample</b>	<b>Water Level (ft)</b>	<b>Result</b>	<b>(PQL)</b>	<b>Detect?</b>	<b>Field Conductivity umh/cm</b>	<b>Field pH S.U.</b>	<b>Field Temp. C°</b>
<b>IW 5</b>	912783-27	12.22.99	REG	44.17	1	(1)	Y	20	4.8	19
<b>IW-6</b>	912783-28	12.22.99	REG	51.83	520	(10)	Y	59	5.1	18
	912783-29	12.22.99	DUP		520	(10)	Y	59	5.1	18
<b>WW-1</b>	912783-13	12.21.99	REG	34.19	1.4	(1)	Y	44	4.9	19
<b>WW-2</b>	912783-14	12.21.99	REG	39.97	3.3	(1)	Y	46	4.9	29
<b>WW-3</b>	912783-15	12.21.99	REG	49.53	2.6	(1)	Y	45	4.8	19
<b>WW-4</b>	912783-16	12.21.99	REG	57.12	31	(1)	Y	46	4.8	19
<b>WW-5</b>	912783-17	12.21.99	REG	37.61	6.4	(1)	Y	40	4.9	19
<b>WW-7</b>	912783-18	12.21.99	REG	29.70	16	(1)	Y	40	4.8	20
<b>WW-8</b>	912783-19	12.21.99	REG	39.34	3.3	(1)	Y	39	5.2	20
<b>WW-9</b>	912783-20	12.21.99	REG	39.12	4.2	(1)	Y	38	4.7	20
<b>WW-10</b>	912783-21	12.21.99	REG	38.20	1	(1)	N	37	4.9	20
<b>WW-12</b>	912783-31	12.22.99	REG	43.03	450	(10)	Y	62	5.4	18
<b>WW-13</b>	912783-32	12.23.99	REG	49.23	410	(10)	Y	66	6.1	19
<b>WW-14</b>	912783-30	12.22.99	REG	46.86	1100	(10)	Y	100	5.9	19
<b>OW-23</b>	912783-2	12.20.99	REG	51.21	1	(10)	N	49	5.8	21
<b>OW-26</b>	912783-23	12.22.99	REG	41.63	4.4	(1)	Y	180	6.5	20
<b>OW-27</b>	912783-24	12.22.99	REG	36.25	320	(1)	Y	100	5.8	20
<b>OW-28</b>	912783-12	12.21.99	REG	33.26	1800	(10)	Y	110	5.7	20
<b>OW-29</b>	912783-9	12.21.99	REG	21.65	1	(1)	N	38	5.1	20
<b>OW-30</b>	912783-10	12.21.99	REG	27.12	1	(1)	N	40	4.6	20

Well:	Lab ID	Date Sampled	Type Sample	Water Level (ft)	Result	(PQL)	Detect?	Field Conductivity umh/cm	Field pH S.U.	Field Temp. C°
OW-31	912783-11	12.21.99	REG	28.29	1100	(10)	Y	42	5.3	20
OW-33	912783-22	12.22.99	REG	38.00	1.2	(1)	Y	78	5.1	20
OW-35	912783-3	12.20.99	REG	32.45	1	(1)	N	40	5.2	20
OW-36	912783-8	12.20.99	REG	24.29	1	(1)	N	43	5.3	20
OW-37	912783-5	12.20.99	REG	30.23	1	(1)	N	62	5	20
OW-37	912783-6	12.20.99	DUP		1	(1)	N	62	5	20
OW-38	912783-4	12.20.99	REG	49.68	1	(1)	N	64	4.7	20
OW-39	912783-7	12.20.99	REG	48.98	1	(1)	N	54	4.9	20
OW-40	912783-1	12.20.99	REG	25.90	1	(1)	N	41	4.7	20
OW-41	912323-2	12.10.99	REG		400	(1)	Y			
	912783-25	12.22.99	REG	26.11	180	(1)	Y	190	6	20
	912783-26	12.22.99	RIN		1	(1)	N			

# GROUND WATER ELEVATIONS DECEMBER 1999



**BENZENE ISOPLETH MAP  
DECEMBER 1999**



**ATTACHMENT D**

**SITE INSPECTION CHECK LIST**

## 1. SITE INFORMATION

Site Name Perdido Groundwater  
Remediation Site

Date of Inspection  
April 5, 2000

Location and Region

EPA ID:

Agency, office or company leading the  
five-year review: Corps of Engineers

Weather/temperature  
Clear & Cool

Remedy Includes (Check all that apply)

- ☐ Landfill cover/containment  
☒ Groundwater pump and treatment  
☐ Surface water collection and treatment  
☐ Other

☒ Inspection team roster attached

☒ Site map attached

## 2. INTERVIEWS (Check all that apply)

1. O&M Site Manager Clyde Hopkins Site Manager April 5, 2000  
Name Title Date

Interviewed ☒ at site ☐ at office ☐ by phone ☐ Phone no. \_\_\_\_\_  
Problems, suggestions; ☒ Report attached \_\_\_\_\_

2. O&M Staff D. C. Harville Maintenance Tech.  
Name Title Date

Interviewed ☐ at site ☐ at office ☐ by phone Phone no. \_\_\_\_\_  
Problems, suggestions; ☐ Report attached Mr. Harville was on-site but not interviewed because of ongoing site activities.

3. Local regulatory authorities and response agencies (i.e., State and Tribal Offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency \_\_\_\_\_  
Contact \_\_\_\_\_  
Name Title Date

Problems, suggestions; ☐ Report attached \_\_\_\_\_

### 3. ONSITE DOCUMENTS & RECORD VERIFIED (Check all that apply)

1. **O&M Manual and As-Builts** ☒ Readily available ☒ Up to date ☐ N/A  
☒ As-builts ☒ Readily available ☒ Up to date ☐ N/A  
☒ Maintenance Logs ☒ Readily available ☒ Up to date ☐ N/A  
Remarks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. **Site Specific Health and Safety Plan** ☒ Readily available ☒ Up to date ☐ N/A  
  
☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date  
☒ N/A  
Remarks \_\_\_\_\_  
\_\_\_\_\_

3. **O&M and OSHA Training Records** ☒ Readily available ☐ Up to date ☐ N/A  
Remarks \_\_\_\_\_  
\_\_\_\_\_

4. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A  
  
Remarks Field copies at site, master list at consultants office.

5. **Permits and Service Agreements**

- ☐ Air Discharge Permit ☐ Readily available ☐ Up to date ☒ N/A  
☐ Effluent discharge ☐ Readily available ☐ Up to date ☒ N/A  
☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☐ N/A  
☐ Other permits \_\_\_\_\_ ☐ Readily available ☐ Up to date ☒ N/A  
Remarks NPDES and air discharge permit not required by State.



**6. Discharge Compliance Records**

☒ Air

☒ Readily available ☒ Up to date ☐ N/A

☒ Water (effluent)

☒ Readily available ☒ Up to date ☐ N/A

Remarks \_\_\_\_\_  
\_\_\_\_\_

**7. Daily Access/Security Logs**

☒ Readily available ☒ Up to date ☐ N/A

Remarks \_\_\_\_\_  
\_\_\_\_\_

**4. O&M COSTS**

**1. O&M Organization**

☐ State in-house

☐ Contractor for State

☐ PRP in-house

☒ Contractor for PRP

☐ Other \_\_\_\_\_  
\_\_\_\_\_

**2. O&M Cost Records**

☒ Readily available

☒ Up to date

☐ Funding mechanism/agreement in place

☐ Original O&M cost estimate \_\_\_\_\_ ☒ Breakdown attached

Total annual costs by year for review period if available

From 1994 To 1995 ☒ Breakdown attached

From 1995 To 1996 ☒ Breakdown attached

From 1996 To 1997 ☒ Breakdown attached

From 1997 To 1998 ☒ Breakdown attached

From 1998 To 1999 ☒ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**  
Describe costs and reasons: PRP and O&M contractor did not disclose any.

## 5. GENERAL SITE CONDITIONS

Whenever possible, actual site conditions should be documented with photographs

### A. FENCING

1. Fencing damaged ☐ Location shown on map ☒ Gates secured ☐ N/A  
Remarks: Fence in good repair.

### B. SITE ACCESS

1. Access restrictions, signs, other security measures ☐ Location shown on map ☐  
N/A  
Remarks: All required signs, warnings, etc. posted on gate.

### C. PERIMETER ROADS

1. Roads damaged ☐ Location shown on map ☒ Roads adequate ☐ N/A  
Remarks: \_\_\_\_\_

### D. GENERAL

1. Vandalism/trespassing ☐ Location shown on site map ☒ No vandalism evident  
Remarks: \_\_\_\_\_

2. Land use changes on site      ☒ N/A

Remarks \_\_\_\_\_  
\_\_\_\_\_

3. Land use changes off site      ☒ N/A

Remarks \_\_\_\_\_  
\_\_\_\_\_

4. Institutional Controls (site conditions imply institutional controls not being enforced)

☒ N/A

Agency \_\_\_\_\_

Contact \_\_\_\_\_

Name

Title

Date

Phone no.

Problems; suggestions;   ☐ Report attached \_\_\_\_\_

\_\_\_\_\_

**6. LANDFILL COVERS   ☐ Applicable   ☒ Not Applicable**

**7. VERTICAL BARRIERS   ☐ Applicable   ☒ Not Applicable**

**8. GROUNDWATER/SURFACE WATER REMEDIES   ☐ Applicable   ☒ Not Applicable**

**A. GROUNDWATER EXTRACTION WELLS, PUMPS AND PIPELINES**

☒ Applicable

☐ Not Applicable

1. **Pumps, Wellhead Plumbing, and Electrical**

☒ Good condition    ☒ All required wells located    ☐ Needs O&M    ☐ N/A

Remarks \_\_\_\_\_

2. **Extraction System Pipeline, Valves, Valve Boxes, and Other Appurtenances**

☒ Good Condition    ☐ Needs O&M

Remarks \_\_\_\_\_

**B. SURFACE WATER COLLECTION STRUCTURES, PUMPS AND PIPELINES**

1. **Collection Structures, Pumps and Electrical**

☐ Good condition    ☐ Needs O&M

Remarks \_\_\_\_\_

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**

☐ Good condition    ☐ Needs O&M

Remarks \_\_\_\_\_

**C. Treatment System**

☐ Applicable

☐ Not Applicable

1. **Treatment Train** (Check components that apply)

☐ Metals removal

☐ Oil/water separation

☐ Bioremediation

☒ Air stripping

☐ Carbon adsorbers

☐ Filters

☐ Others \_\_\_\_\_

☒ Good condition

☐ Needs O&M

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☒ Quantity of groundwater treated annually: 82,822,000

☐ Quantity of surface water treated annually \_\_\_\_\_

Remarks \_\_\_\_\_

**2. Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A

☒ Good condition

☐ Needs O&M ☐ N/A

Remarks \_\_\_\_\_

\_\_\_\_\_

**3. Tanks, Vaults, Storage Vessels** ☐ N/A

☒ Good condition

☐ Proper secondary containment

☐ Needs O&M

Remarks \_\_\_\_\_

\_\_\_\_\_

**4. Discharge Structures and Appurtenances** ☐ N/A

☒ Good condition

☐ Needs O&M

Remarks \_\_\_\_\_

\_\_\_\_\_

**5. Treatment Buildings**

☐ N/A

☒ Good condition

☐ Needs repair

☐ Chemicals and equipment properly stored

Remarks: No chemicals used in treatment process.

\_\_\_\_\_

**6. Monitoring Wells** (pump and treatment remedy) ☒ Properly secured and locked

☒ Functioning

☒ Routinely sampled

☒ Good condition

☒ All required wells

located

☐ Needs O & M

☐ N/A

Remarks \_\_\_\_\_

\_\_\_\_\_

**D. MONITORED NATURAL ATTENUATION**

**1. Monitoring Wells** (Natural attenuation remedy)

☐ Properly secured/locked

☐ Functioning

☐ Routinely sampled

☐ Good condition

☐ All required wells located

☐ Needs O&M ☐ N/A

Remarks \_\_\_\_\_

\_\_\_\_\_

**A. IMPLEMENTATION OF THE REMEDY**

The remedy has been implemented in accordance with the requirements of the ROD, Consent Decree, and Explanation of Significant Differences. Additionally, the system has been modified by changing to more effective and efficient submersible pumps and by converting to a simpler easier to maintain, but effective, air stripper. The remedy at the site is protecting human health and the environment by remediating the benzene contaminated groundwater and by preventing the migration of the benzene plume.

**B. ADEQUACY OF O&M**

This plant is very well maintained. The equipment is clean, well serviced and operating as design. The air stripper and air compressor that were high maintenance items have been replaced. The plant is inspected daily and the inspection details are recorded. The records are reviewed to make sure that required maintenance such as pump and well screen cleaning and servicing is performed as required. If this level of O&M effort is maintained the plant should remain functional and effective for several additional years.

<b>C. EARLY INDICATORS OF POTENTIAL REMEDY FAILURE</b>



**D. OPPORTUNITIES FOR OPTIMIZATION**

#### **E. BIOSPARGING WELLS:**

The biosparging wells are relatively new and appeared to be in very good condition and functioning as design.

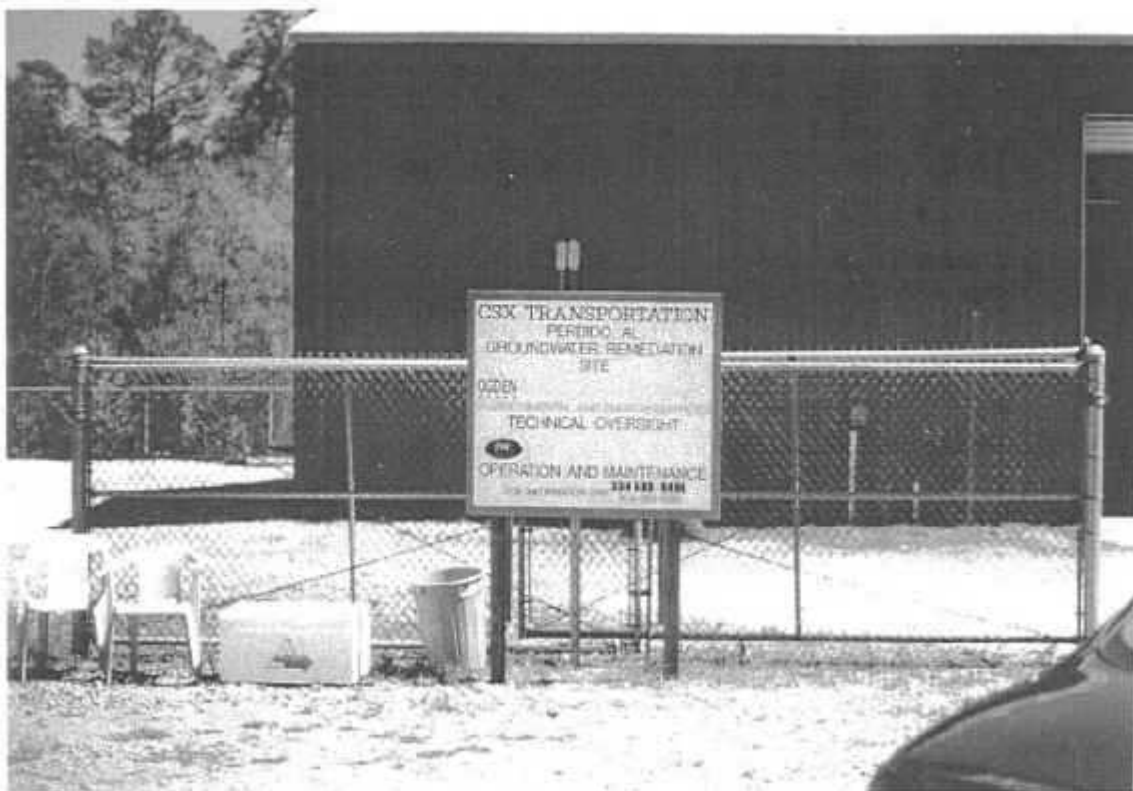
#### **9. OVERALL OBSERVATIONS:**

The PGCS appears to be very well maintained with required and preventative maintenance performed in a timely and efficient manner. All of the equipment is well maintained and functional. Ogden Environmental is actively investigating the problems caused by iron and sediment accumulation/incrustation, which was the only problem noted with system operations. Iron and sediment accumulations are common problems in pump and treat systems and should not pose a threat to the continued successful operation of the remedy.

### Itemized O&M Expenses for PGCS 1995 - 1999

	1995	1996	1997	1998	1999	2000	Totals
Power	\$23,972.00	\$45,746.00	\$47,059.00	\$30,078.00	\$24,000.00	\$8,000.00	\$178,855.00
Telephone	\$874.00	\$1,149.00	\$1,249.00	\$735.00	\$1,000.00	\$400.00	\$5,407.00
Laboratory Fees	\$13,581.00	\$14,334.00	\$11,964.00	\$14,102.00	\$18,556.00	\$5,372.00	\$77,909.00
Land Leases	\$5,500.00	\$7,000.00	\$7,000.00	\$32,500.00	\$6,250.00	\$8,750.00	\$67,000.00
O&M Contractor	\$155,722.00	\$195,494.00	\$150,849.00	\$342,620.00	\$299,906.00	\$122,101.00	\$1,266,692.00
O&M Support	\$34,134.00	\$21,536.00	\$22,385.00	\$4,456.00	\$853.00		\$83,364.00
Consultants	\$83,522.00	\$73,090.00	\$145,710.00	\$43,040.00	\$87,583.00	\$16,988.00	\$449,933.00
Totals	\$317,305.00	\$358,349.00	\$386,216.00	\$467,531.00	\$438,148.00	\$161,611.00	\$2,129,160.00

**ATTACHMENT E**  
**SITE PHOTOGRAPHS**



PROJECT SIGN



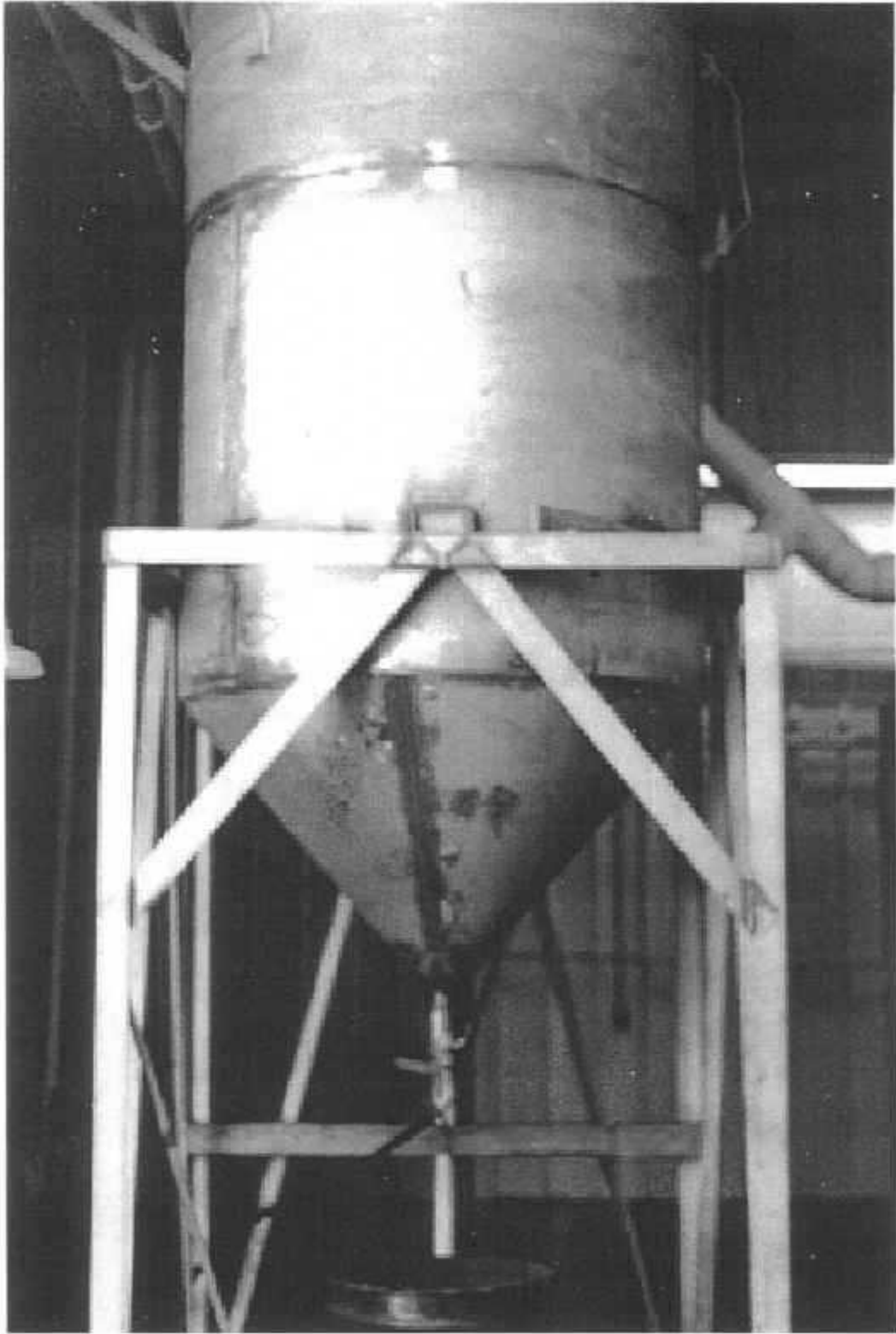
SAFETY AND SECURITY SIGNS ON FENCE GATE



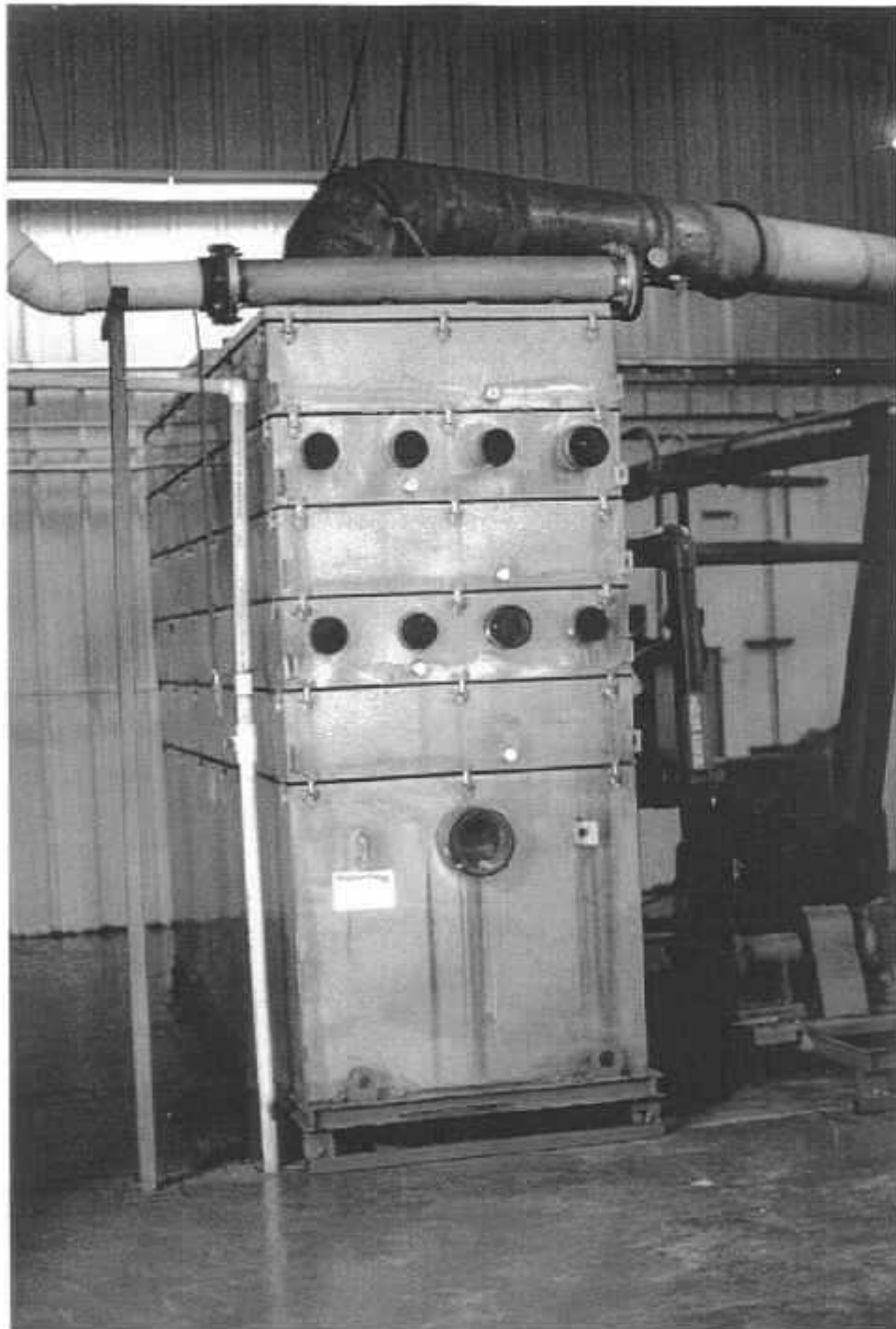
TREATMENT FACILITY BUILDING



INFLUENT LINES FOR DESANDER

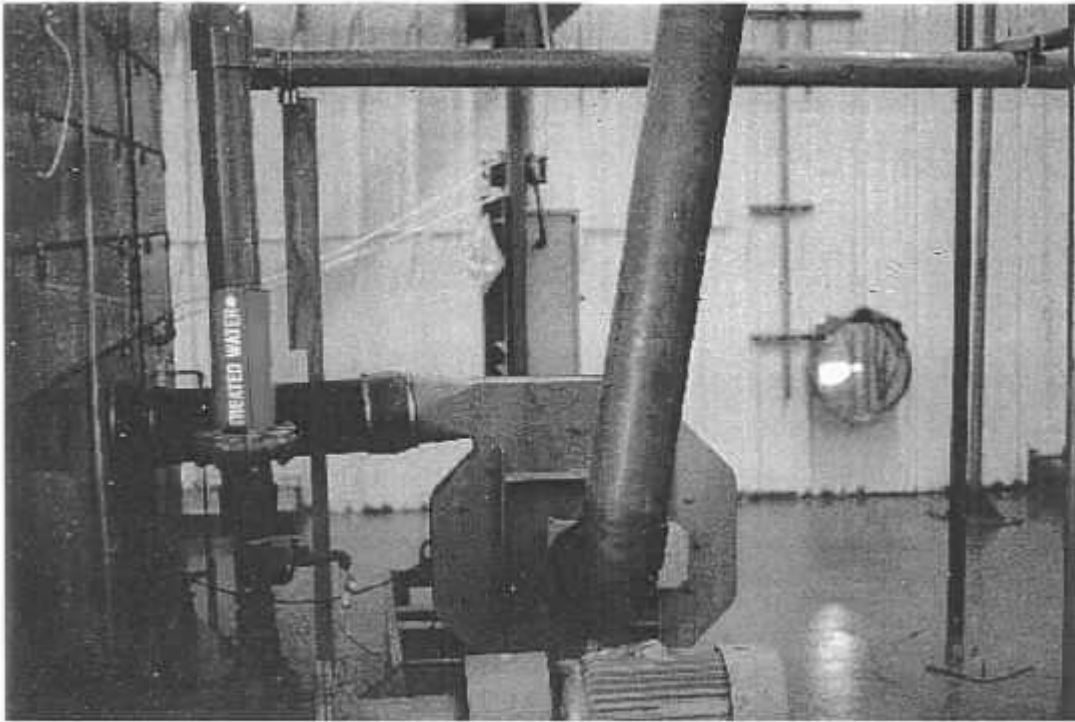


CLEANOUT FOR DESANDER



SHALLOW TRAY AIR STRIPPER

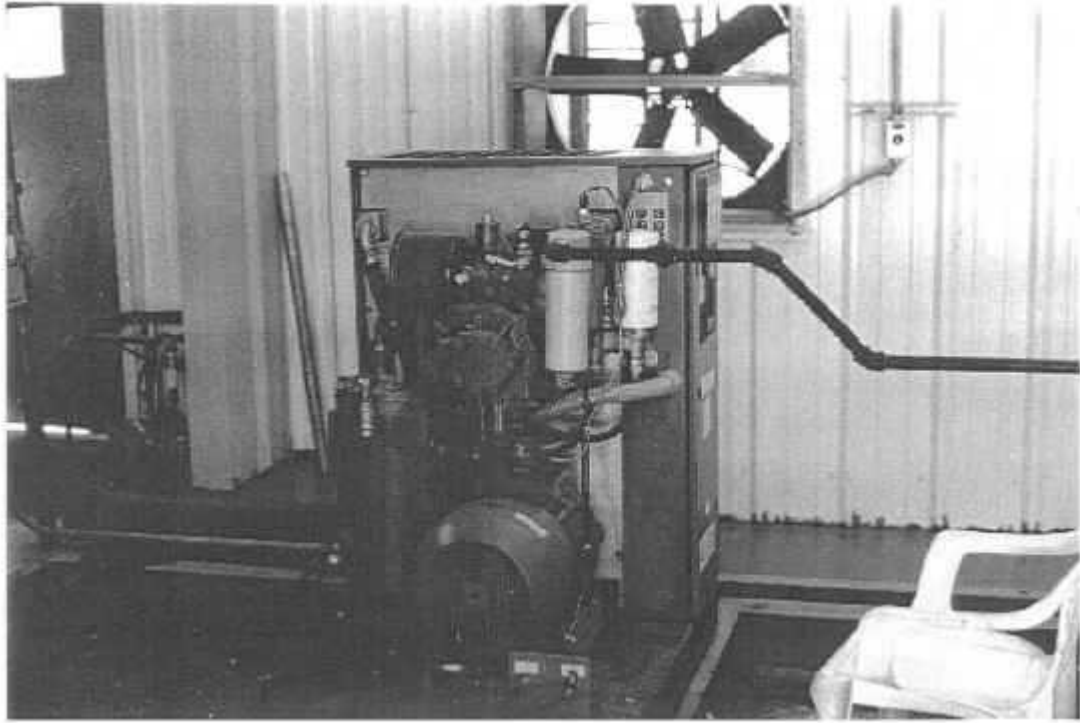




EXHAUST BLOWER FOR AIR STRIPPER



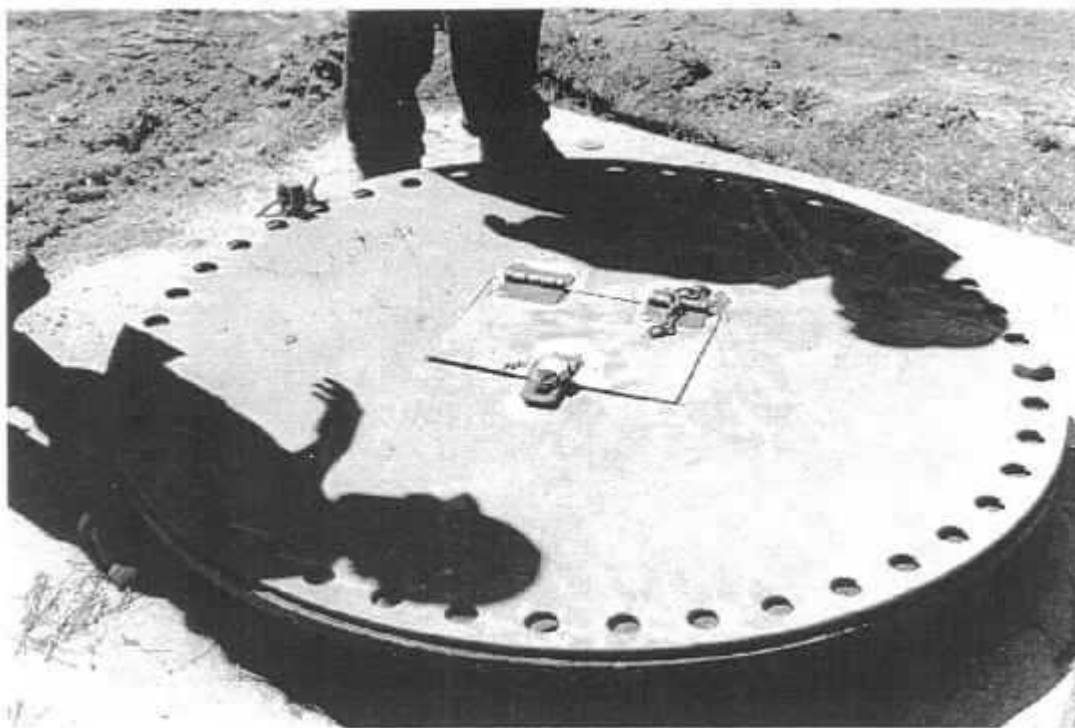
EFFLUENT BAG FILTER UNITS



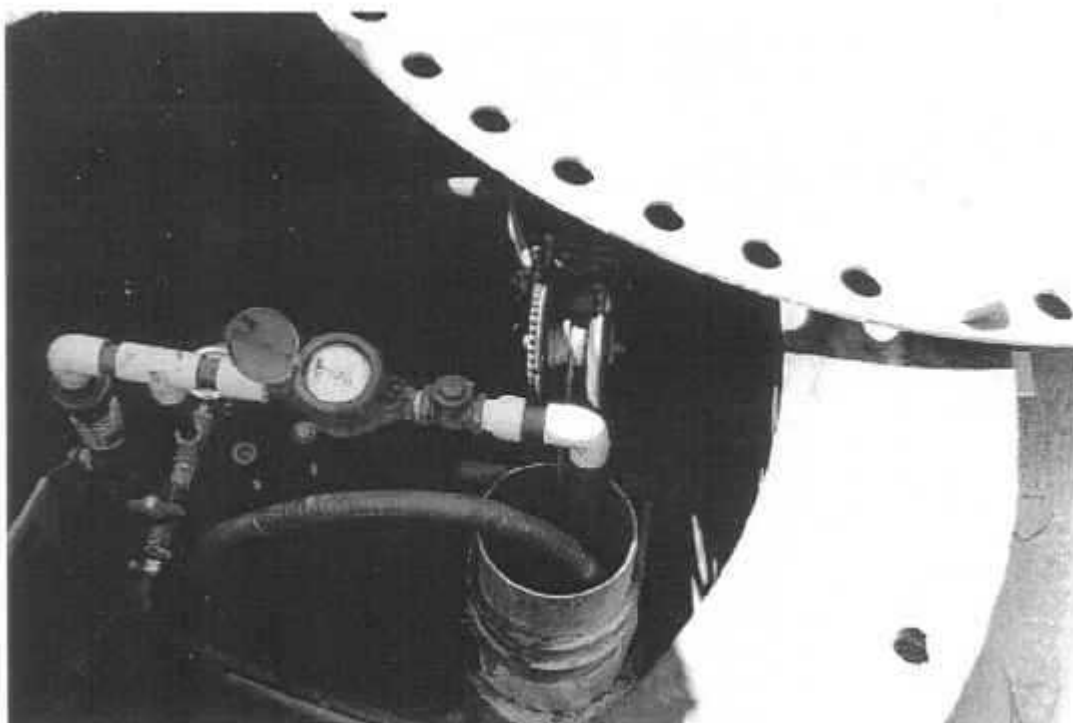
AIR COMPRESSOR FOR BIOSPARGE WELLS



CONTROL BOX FOR WELL WW-12



WELL COVER WW-12



WELL WW-12 AND APPURTENANCES



BIOSPARGE WELLS BS-3



EFFLUENT DISCHARGE TO SURFACE WATER